

Laser Spectroscopy Multi-Gas Monitor: Results of Technology Demonstration on ISS

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Tunable diode laser spectroscopy (TDLS) is an up and coming trace and major gas monitoring technology with unmatched selectivity, range and stability. The technology demonstration of the 4 gas Multi-Gas Monitor (MGM), reported at the 2014 ICES conference, operated continuously on the International Space Station (ISS) for nearly a year. The MGM is designed to measure oxygen, carbon dioxide, ammonia and water vapor in ambient cabin air in a low power, relatively compact device. While on board, the MGM experienced a number of challenges, unplanned and planned, including a test of the ammonia channel using a commercial medical ammonia inhalant. Data from the unit was downlinked once per week and compared with other analytical resources on board, notably the Major Constituent Analyzer (MCA), a magnetic sector mass spectrometer. MGM spent the majority of the time installed in the Nanoracks Frame 2 payload facility in front breathing mode (sampling the ambient environment of the Japanese Experiment Module), but was also used to analyze recirculated rack air. The capability of the MGM to be operated in portable mode (via internal rechargeable lithium ion polymer batteries or by plugging into any Express Rack 28VDC connector) was a part of the usability demonstration. Results to date show unprecedented stability and accuracy of the MGM vs. the MCA for oxygen and carbon dioxide. The ammonia challenge (~ 75 ppm) was successful as well, showing very rapid response time in both directions. Work on an expansion of capability in a next generation MGM has just begun. Combustion products and hydrazine are being added to the measurable target analytes. An 8 to 10 gas monitor (aka Gas Tricorder 1.0) is envisioned for use on ISS, Orion and Exploration missions.